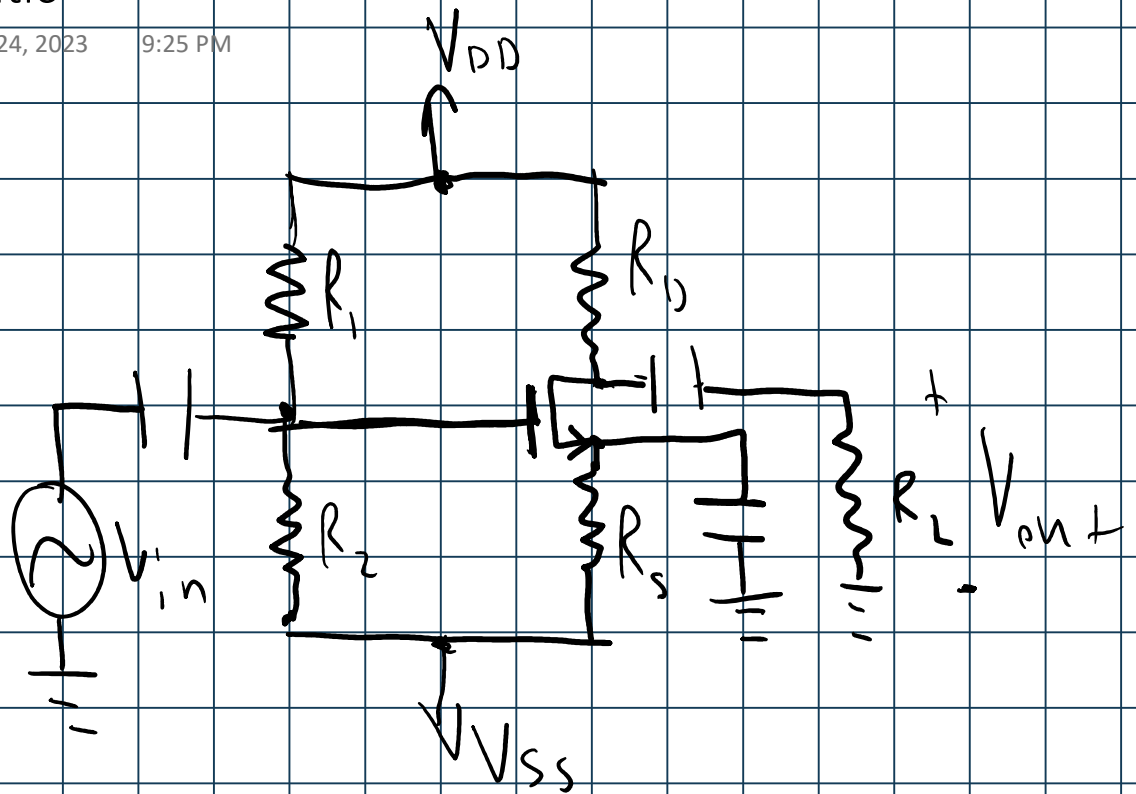
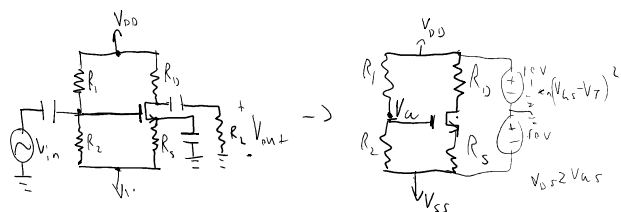


# Schematic

Monday, April 24, 2023

9:25 PM





$$V_{gs} = V_{DD} - (V_{DD} - V_{ss}) \frac{R_1}{R_1 + R_2}$$

$$V_{gs} = -0.526V$$

$$V_{gs} = V_{gs} - V_{ss}, \quad V_{ds} = V_{gs} - (V_{ss} + I_D R_s)$$

$$I_D = k_2 (V_{gs} - V_{th} - I_D R_s - V_T)^2$$

$$I_D = k_2 ((V_{gs} - V_{ss} - V_T) - I_D R_s)^2$$

$$x = (V_{gs} - V_{ss} - V_T)$$

$$I_D = \frac{1}{2} k (x - I_D R_s)^2$$

$$I_D = \frac{1}{2} k (x^2 - 2x R_s I_D + R_s^2 I_D^2)$$

$$I_D = \frac{1}{2} k x^2 - k x R_s I_D + \frac{1}{2} k R_s^2 I_D^2$$

$$0 = \frac{1}{2} k x^2 + (-k x R_s - 1) I_D + \frac{1}{2} k R_s^2 I_D^2$$

$$R_{eq} + S: I_D = 701 \mu A, 6777.8 \mu A$$

$$V_{ds} = V_{gs} - (V_{ss} + I_D R_s)$$

$$\text{For } I_D = 701 \mu A,$$

$$V_{ds} = 2.113V, \quad V_{ds} < V_T \therefore I_D \neq 701 \mu A$$

$$\text{For } I_D = 6777.8 \mu A,$$

$$(ab - ac)^2$$

$$a^2 b^2 - 2 a^2 b c + a^2 c^2$$

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$$\text{For } I_D = 677.8 \mu\text{A},$$

$$\boxed{V_{GS} = 2.357 \text{ V}}, \quad V_{GS} > V_T, \therefore \boxed{I_D = 678 \mu\text{A}}$$

$$V_{DD} - I_D R_D - V_{GS} - I_D R_S = V_{SS}$$

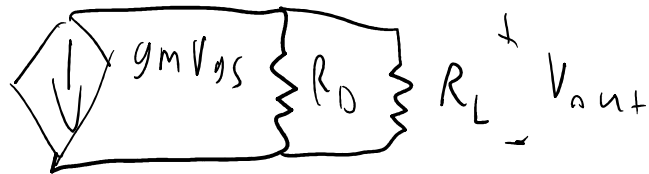
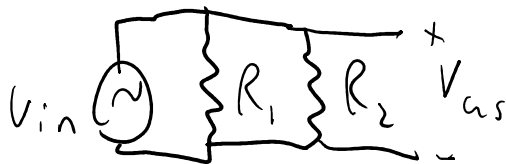
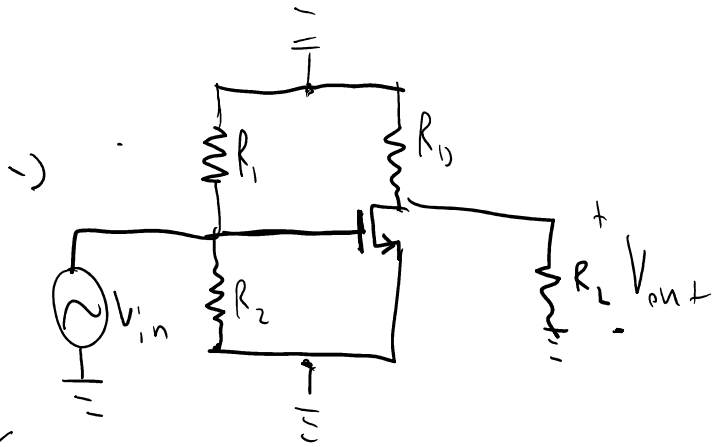
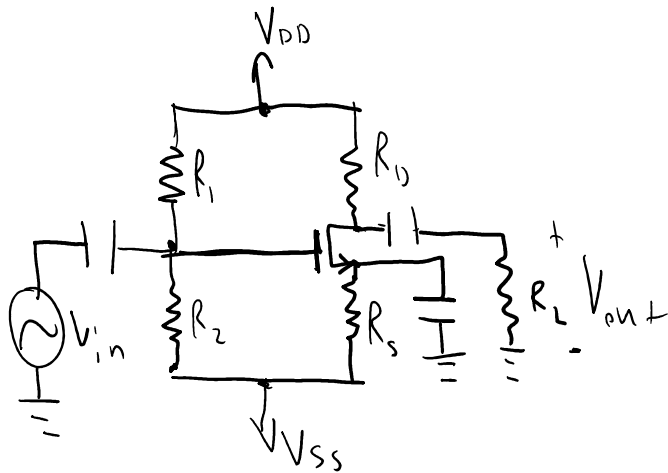
$$V_{DD} - I_D R_D - I_D R_S - V_{GS} = V_{DS}$$

$$\boxed{V_{DS} = 6.783 \text{ V}}$$

A

# AC Analysis

Tuesday, April 25, 2023 4:45 PM



$$V_{gs} = V_{in} \quad g_m = \frac{2I_D}{V_{ov}} = 0.012$$

$$V_{out} = -g_m V_{in} \cdot R_D \parallel R_L$$

$$A_{gain} = \frac{V_{out}}{V_{in}} = -g_m R_D \parallel R_L$$

$$r_{in} = R_1 \parallel R_2 = \frac{R_1 R_2}{R_1 + R_2} = 7.105 k\Omega$$

$$r_{out} = R_D \parallel R_L = 6.207 k\Omega$$

$$A_{gain} = -69.774 \frac{V}{V}$$